

to the convective area is evident, indicating an extremely favorable inflow of warm moist air in the critical low levels. The origin of the air in this easterly current was tropical as shown by the southward turning of the contour lines only a few miles upwind. The geostrophic wind was measured at 080°, 48 m. p. h. at the point of contact with the shower area.

The closed circulation at the surface and 850-mb. levels disappeared at the 700-mb. level (fig. 11). Cyclonically curved isobars brought in air from the southeast into the convective system.

The influence of the Low was fading at the 500-mb. level (fig. 12), while at 300 mb. (fig. 13) there appears to have been almost no influence of the surface system.

PROPOSED MECHANISM

The 1900 CST 850-mb. chart (fig. 10) must be thought of as a first approximation to the true conditions above the Holt storm center at that level. The temperature field in the convective area is, of course, the main unknown. Byers and Braham [3] suggest that the temperature at the 850-mb. level decreases somewhat in a thunderstorm rain area and that a very considerable cooling (about 5° C.) occurs in the 2,000–4,000 ft. layer. The 850-mb. cooling occurs about 3 miles to the rear of the surface wind shift line (in the average mature cell case). Since the cooling in the lower layers in the Holt storm was evaporational in nature, rather than frontal, it is probable that the horizontal temperature gradient at the 2,000–4,000 ft. level was only of the order of 2 miles to the rear of the surface outflow cooling. On the 850-mb. chart (fig. 10) the effect of the small Low was to turn the winds at that level from a previously southerly direction to a strong easterly. This could have the effect of forming a cross isotherm pattern of extraordinary strength and concentration. Areas of warm differential advection, especially if concentrated in the lowest layers, have been linked with strong vertical velocities [4]. A certain amount of conditional instability is favorable for continu-

ation of the lifting process once the level of free convection is pierced (700 mb. in this case).

SUMMARY

This remarkably intense rainstorm was probably caused by a combination of several factors. Of great importance was the conditional instability in the tropical air mass. While the instability was a necessary condition for the storm and favored the development of warm sector convective systems, it was not sufficient to cause this explosive storm. A unique factor was the tightening of the pressure gradient north of an instability-line Low, causing an extraordinarily strong low-level flow of unstable air into the pre-existing convective system. The Holt storm occurred precisely at the point of injection into the convective system of the strongest winds in the layer between the surface and 850 mb.

It can be surmised that an area of strong differential advection could have been formed by the action of the combination of a pre-existent sharp temperature gradient and a sudden formation of a strong wind at right angles to this gradient by the uncommon pressure distribution.

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REFERENCES

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3. H. R. Byers and R. D. Braham, *The Thunderstorm*, U. S. Weather Bureau, Washington, D. C., June 1949.
4. C. S. Gilman, An Expansion of the Thermal Theory of Pressure Changes, ScD Thesis, Massachusetts Institute of Technology, 1949, (unpublished).

CORRECTION

MONTHLY WEATHER REVIEW, vol. 82, No. 1, Jan. 1954, page 19: In the legends within figures 9a and 9b lines WW should be keyed as x x x and lines WWW as • • • .